Table 3. Similarity indices (based on Sorenson's index) for avian species observed in old-growth/seral (OGS), prescribed burn (PB), and clearcut (CC) stands during May-June, 1993 in Owyhee County, Idaho.

| | OGS | PB | # spp. in common | OGS | CC | # spp. in common | PB | CC | # spp. in common |
|---|---|---|---|---|---|---|---|---|---|
| 50 m | 30 | 23 | 19 | 30 | 22 | 18 | 23 | 22 | 15 |
| % similarity | | 71.7 | | | 69.2 | | | 66.7 | |
| 125 m | 32 | 30 | 24 | 32 | 26 | 23 | 30 | 26 | 22 |
| % similarity | | 77.4 | | | 79.3 | | | 78.6 | |
| overall | 33 | 31 | 25 | 33 | 31 | 25 | 31 | 31 | 25 |
| % similarity | | 78.1 | | | 78.1 | | | 80.6 | |

Table 4. Similarity indices (based on Sorenson's index) for avian species observed during three sample periods [A = 2-16 May 1993 (Pleasant Valley PB sample A was conducted on 30 May), B = 17-29 May 1993 (Pleasant Valley PB sample B was conducted on 13 June), C = 11-28 June 1993] in Owyhee County, Idaho.

| | A | B | # spp. in common | A | C | # spp. in common | B | C | # spp. in common |
|---|---|---|---|---|---|---|---|---|---|
| 50 m | 22 | 23 | 16 | 22 | 26 | 16 | 23 | 26 | 15 |
| % similarity | | 67.9 | | | 52.4 | | | 63.2 | |

1.9%). Gray flycatcher numbers increased in all treatments (OG/S - 10.7%-16%, PB - 10.6%-17.2, CC - 4.9%-11%). Mountain chickadee numbers decreased in OG/S plots (10.2%-1.6%). House wren numbers decreased in CC plots (13.4%-9.5%). Mountain bluebird numbers increased in OG/S plots (6%-10.4%) and decreased in PB (18.2%-15%) and CC (19.5%-8.8%) plots. Green-tailed towhee numbers increased in CC plots (6.1%-8.1%). Vesper sparrow numbers decreased in CC plots (15.8%-9.6%). Chipping sparrow numbers decreased in OG/S (21.4%-16.5%) and CC (19.5%-7.4%) plots and increased in PB plots (11.4%-15%). Dark-eyed junco numbers increased in OG/S plots (5.2%-8.2%). Brown-headed cowbird numbers decreased in PB plots (6.4%-0.5%). Cassin's finch numbers increased in OG/S (6.6%-12.5) and PB (4.2%-7%) plots.

Number of species ($r^2 = 0.31$, $F = 91.1$, $P < 0.001$) and number of birds seen ($r^2 = 0.25$, $F = 67.1$, $P < 0.001$) were different between treatments for 1992 and 1993 combined. However, they were not different between years (species: $F = 2.6$, $P = 0.107$; total: $F = 2.7$, $P = 0.101$). Number of species ($r2 = 0.44$, $F = 28.8$, $P < 0.001$) and number of birds ($r2 = 0.37$, $F = 20.7$, $P < 0.001$) were different between transects for 1992 and 1993 combined. OG/S and the Pleasant Valley PB transect had greater numbers of species and birds than the other PB and CC transects.

Similarity indices were 3.5% (PB-CC), 7.4% (OG/S-PB), and 16.8% (OG/S-CC) greater in 1993 than in 1992 for the 50 m plots. Indices were even greater when overall numbers were compared.

## DISCUSSION

Greater avian abundance and species diversity in OG/S was probably best explained by greater structural diversity. Understory components were similar between treatments, however, cover was greater in OG/S than PB or CC treatments (McCoy 1993). While OG/S stands had no juniper snags and few logs, they had greater diversity and abundance of live junipers. Vegetation composition and structure in the Pleasant Valley PB closely resembled OG/S stands resulting in similar avian abundance and diversity (Appendix C). PB treatments with a > 20% kill rate had relatively open understories that provided less cover for ground foraging species compared to CC sites with slash.

Weather may have influenced changes in species composition and abundance between years. Greater precipitation in 1993 than 1992 may have had variable effects on avian populations. Increased precipitation could result in greater insect and seed production and consequently greater avian productivity, however, extended cool, wet weather may have caused some nest failures. Generalist species may have been favored resulting in lower diversity and greater similarity of avian species between treatments.

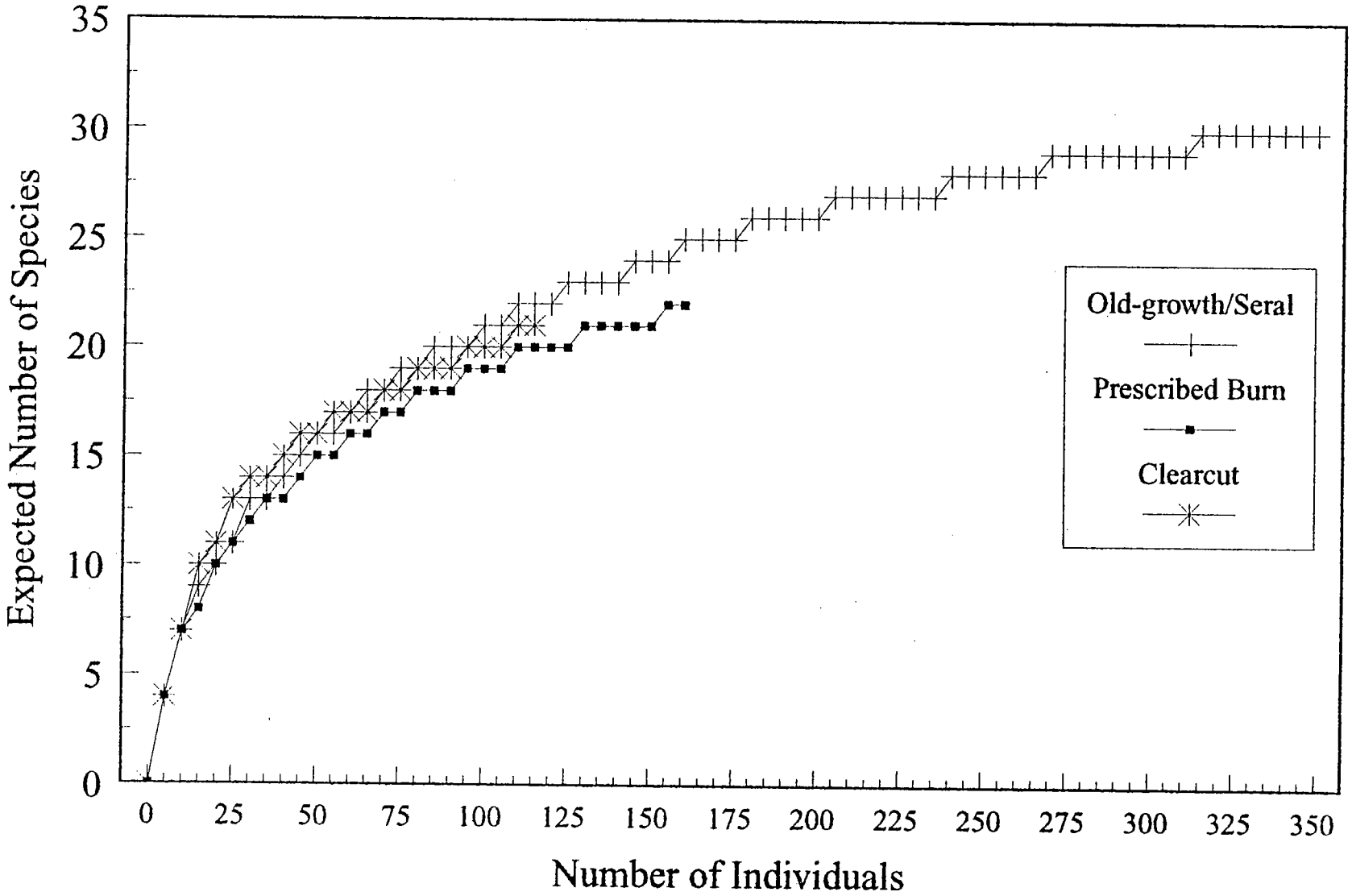


Figure 4. Rarefaction predictions of species numbers based on number of birds observed in old-growth/seral, prescribed burn, and clearcut stands sampled in May-June 1993, Owyhee County, Idaho.

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Appendix A. Numbers of birds observed during 2 May through 28 June 1993 at 70 points in old-growth/seral (OGS), prescribed burn (PB), and clearcut (CC) stands in Owyhee County, Idaho.

| Species | Species Code | All distances | | | w/in 125 m | | | w/in 50 m | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | OGS | PB | CC | OGS | PB | CC | OGS | PB | CC |
| Canada goose | CAGO | | | | 4 | | | | | |
| Common snipe | COSN | 1 | 5 | 1 | 1 | 5 | 1 | | 3 | 1 |
| Turkey vulture | TUVU | 2 | | 8 | 2 | | 1 | 1 | | |
| Red-tailed hawk | RTHA | 3 | 5 | | 3 | 5 | | 3 | 3 | |
| American kestrel | AMKE | 5 | | 3 | 5 | | 3 | 3 | | 1 |
| Prairie falcon | PRFA | | 2 | | | 2 | | | | |
| Mourning dove | MODO | 9 | 4 | 5 | 9 | 4 | 4 | 3 | | 1 |
| Great-horned owl | GHOW | | 2 | | | | | | | |
| Common poorwill | COPW | 1 | | | 1 | | | | | |
| Common nighthawk | CONI | | 1 | | | 1 | | | | |
| Calliope hummingbird | CAHU | | 1 | 1 | | 1 | 1 | | 1 | 1 |
| Unknown hummingbird | UNHU | 3 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 1 |
| Northern flicker | NOFL | 20 | 25 | 16 | 19 | 25 | 10 | 9 | 4 | 1 |
| Red-naped sapsucker | RNSA | | 2 | 2 | | 2 | 1 | | 1 | |
| Downy woodpecker | DOWO | 1 | | | 1 | | | 1 | | |
| Gray flycatcher | GRFL | 84 | 64 | 32 | 84 | 64 | 32 | 68 | 37 | 15 |
| Dusky flycatcher | DUFL | 2 | | | 2 | | | 2 | | |
| Unknown flycatcher | UNFL | 1 | | 2 | 1 | | 2 | 1 | | 2 |
| Tree swallow | TRES | | | 11 | | | 11 | | | 10 |
| Violet-green swallow | VGSW | 2 | | 10 | 2 | | 10 | 2 | | 8 |
| Black-billed magpie | BBMA | | 1 | | | 1 | | | | |
| Common raven | CORA | 111 | 14 | 20 | 103 | 4 | 6 | 16 | 1 | 2 |
| Mountain chickadee | MOCH | 10 | 2 | 7 | 10 | 2 | 7 | 7 | | 4 |
| Red-breasted nuthatch | RBNU | 1 | | | 1 | | | 1 | | |
| House wren | HOWR | 13 | 15 | 25 | 13 | 14 | 22 | 9 | 10 | 13 |

| Species | Species Code | All distances | | | w/in 125 m | | | w/in 50 m | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | OGS | PB | CC | OGS | PB | CC | OGS | PB | CC |
| Rock wren | ROWR | 7 | 4 | 5 | 7 | 4 | 5 | 3 | 3 | 1 |
| Ruby-crowned kinglet | RCKI | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | |
| Mountain bluebird | MOBL | 68 | 65 | 30 | 68 | 64 | 30 | 44 | 32 | 12 |
| Hermit thrush | HETH | 38 | 1 | 8 | 36 | 1 | 4 | 10 | 1 | |
| American robin | AMRO | 59 | 24 | 25 | 59 | 23 | 22 | 30 | 6 | 5 |
| Yellow warbler | YEWA | | | 1 | | | | | | |
| Yellow-rumped warbler | AUWA | 5 | 3 | 2 | 5 | 3 | | 4 | 3 | |
| Black-throated gray warbler | BTYW | 4 | | | 4 | | | 3 | | |
| Unknown warbler | UNWA | 1 | | | 1 | | | 1 | | |
| Green-tailed towhee | GTTO | 8 | 2 | 21 | 8 | 2 | 21 | 7 | | 11 |
| Vesper sparrow | VESP | 7 | 62 | 32 | 7 | 59 | 32 | 5 | 26 | 13 |
| Chipping sparrow | CHSP | 103 | 56 | 16 | 103 | 56 | 16 | 70 | 32 | 10 |
| Brewer's sparrow | BRSP | 5 | 47 | 49 | 5 | 46 | 49 | 1 | 5 | 12 |
| Dark-eyed junco | DEJU | 49 | 11 | 1 | 49 | 11 | | 35 | 8 | |
| Western meadowlark | WEME | 5 | 21 | 1 | | 10 | | | 2 | |
| Red-winged blackbird | RWBL | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | 2 |
| Brewer's blackird | BRBL | 3 | 4 | 19 | 3 | 4 | 19 | 3 | 2 | 9 |
| Brown-headed cowbird | BHCO | 25 | 2 | 3 | 25 | 2 | 2 | 21 | 1 | 1 |
| Pine siskin | PISI | 2 | 4 | | 2 | 4 | | 2 | 4 | |
| Cassin's finch | CAFI | 85 | 23 | 8 | 85 | 23 | 8 | 53 | 15 | 2 |
| Unknown | UNKN | 85 | 46 | 23 | 85 | 46 | 23 | 58 | 20 | 6 |
| Totals | | 835 | 523 | 397 | 818 | 49 | 344 | 483 | 234 | 14 |
| Identified species | | 33 | 31 | 31 | 32 | 30 | 26 | 30 | 23 | 22 |
| Unknown | | 4 | 2 | 3 | 4 | 2 | 3 | 4 | 2 | 3 |

Appendix B. Number of species and individuals (mean ± one standard deviation) by sampling period and treatment for avian surveys conducted 2 May through 28 June 1993 in Owyhee County, Idaho. Sample period 1 conducted 3-17 May, sample period 2 conducted 21-31 May, and sample period 3 conducted 18-21 June 1993.

| Treatment | Transect Location | # species | | | # birds | | |
|---|---|---|---|---|---|---|---|
| | | Sample 1 | Sample 2 | Sample 3 | Sample 1 | Sample 2 | Sample 3 |
| Old Growth/ Seral | Stoneman Cr. | 3.33±0.52 | 3.33±1.03 | 3.50±1.05 | 4.00±0.63 | 5.17±2.14 | 6.17±1.94 |
| | Rays Res. East | 3.13±1.46 | 4.38±1.51 | 5.38±2.20 | 4.25±2.25 | 6.50±2.39 | 9.00±3.55 |
| | Pleasant Valley | 4.33±1.53 | 3.67±0.58 | 4.33±1.16 | 6.67±1.16 | 9.33±0.58 | 8.67±4.04 |
| | Juniper Mtn | 4.00±0.00 | 5.33±1.53 | 5.00±5.51 | 4.67±1.16 | 8.33±4.16 | 7.67±5.51 |
| | Rays Res. West | 4.25±1.26 | 5.00±0.82 | 4.25±2.22 | 6.25±1.71 | 7.00±1.63 | 6.75±2.67 |
| | Combined | 3.64±1.15 | 4.20±1.32 | 4.60±2.02 | 4.96±1.84 | 6.72±2.56 | 7.64±3.52 |
| Prescribed Burn | Sam Noble | 0.58±0.67 | 1.00±0.85 | 1.08±0.67 | 1.00±1.21 | 1.25±1.22 | 1.42±1.24 |
| | Pleasant Valley | 3.25±0.89 | 3.63±1.85 | 2.63±0.92 | 5.00±1.51 | 6.13±2.90 | 4.13±2.17 |
| | Cottonwood Cr. | 2.17±1.94 | 2.67±1.37 | 1.67±1.37 | 2.50±2.07 | 4.00±2.37 | 3.17±2.64 |
| | Combined | 1.77±1.61 | 2.19±1.74 | 1.69±1.12 | 2.58±2.28 | 3.39±2.97 | 2.65±2.21 |
| Clear Cut | Pleasant Valley | 0.29±0.49 | 2.86±1.07 | 1.71±0.76 | 0.43±0.79 | 3.86±1.35 | 2.00±0.82 |
| | Juniper Mtn | 1.71±1.38 | 2.00±1.16 | 1.43±0.54 | 2.00±1.41 | 2.43±1.51 | 1.71±0.76 |
| | Hanley Cabin | 1.40±1.14 | 2.20±0.84 | 2.20±0.45 | 1.40±1.14 | 5.20±5.12 | 4.40±3.78 |
| | Combined | 1.11±1.20 | 2.37±1.07 | 1.74±0.65 | 1.26±1.26 | 3.68±2.91 | 2.53±2.22 |

Appendix C. Transect descriptions for avian population sampling in old-growth/seral, prescribed burn, and clear cut stands of western juniper in Owyhee County, Idaho.

**Old-growth/Seral**

Stoneman Creek (6 points) - This transect was located on both sides of the Mud Flat road on a saddle between two drainages. One point on the west side of the road was in a moderately older-aged stand with a few trees removed during prior logging activity. The other point on the west side of the road was located in a younger (estimated <45 years old) seral stand. Points on the east side of the road were located in primarily old-growth stands ranging from fairly shallow soils with rocky outcrops to a somewhat deeper soil with moderate-aged (about 100-125 years) trees. Understory cover was greatest in areas with deeper soils and younger or more open stands of juniper. The nearest water was approximately one-mile away.

Rays Reservoir East (8 points) - This transect was divided by a series of low rocky ridges and dry to semi-wet drainages. Old-growth juniper dominated the ridges and upper slopes with younger (estimated < 75 years old) trees on lower slopes and into meadows. Sample points were generally located in moderate-aged (50-150 years old) stands. There was a spring and reservoir on the transect. A clear cut was initiated on the southeast border of the transect in 1994. One point was clear cut after sampling was completed.

Rays Reservoir West (4 points) - This transect was located on two ridges with old-growth stands of juniper, bisected by a small semi-wet meadow. A spring also existed on the northwest side of the transect.

Pleasant Valley (3 points) - This transect was located adjacent to the Pleasant Valley clear cut transect. The transect was dominated by trees < 100 years old with scattered older (> 150 years old) trees. Pleasant Valley Creek or the spring on the Rays Reservoir West transect were the closest water sources.

Juniper Mountain (3 points) - This transect was dominated by moderate-aged (50-80 years old) trees with old-growth trees on rocky outcrops. This transect had the greatest canopy cover and sparsest understory. It was located adjacent to a perennial stream.

**Prescribed Burn**

Sam Noble (12 points) - This site was burned in 1985 with approximately 40-50% kill of junipers. The stand was fairly open and consisted of younger (<60 years old) trees prior to burning. Pockets of live junipers were widely scattered throughout the transect. Most of the dead junipers were still standing during the sample period. Most points were located in fairly open areas with < half containing some live junipers within 50 m. Water was available within 1/4 to 1 mile to the west of points in the transect.

Pleasant Valley (8 points) - This site was burned in 1985 with < 20% kill of junipers. The site contained a mixture of old and moderate aged trees. Burned areas were generally < 50 m in

diameter. This transect was very similar in structure to old-growth/seral stands. A reservoir was located within ½ mile of any point.

Cottonwood Creek (6 points) - The site was burned in 1985. The western portion (2 points) experienced a <25% kill and was adjacent to a perennial stream. It had a mixture of old and moderate aged live trees. The eastern portion (4 points) experienced a 45% kill and was located within ½ mile of water. This portion had been dominated by trees < 65 years old prior to treatment. Pockets of live juniper remained within 125 m of each point. This site also included on old-growth/seral point.

**Clear Cut**

Pleasant Valley (7 points) - This site was cut in 1986-91 The site had fairly shallow soils and was dominated by old-growth trees prior to cutting. Slash up to 1 m deep was common on the site. Old-growth stands ringed the site and extended into the cut area. Pleasant Valley Creek and the spring in Rays Reservoir West were the nearest sources of water.

Hanley Cabin (5 points) - This site was cut in 1990-92. Prior to cutting there was a mixture of young to old trees in moderately deep soils interspersed with semi-wet to wet stringer meadows. There was a small (< 5 acres) stand of aspen around a spring on the perimeter of the cut. Slash up to 1 m deep was common on the site.

Juniper Mountain (7 points) - This site was burned in 1981 and cut in 1982-83. Prior to treatment, there was a mixture of moderate to old (> 50 years old) junipers. There was a complex interspersion of live trees, snags, and open spaces after treatment. Some pockets of partially or un-burned slash were present.


**Bureau of Land Management**
Idaho State Office
1387 S. Vinnell Way
Boise, Idaho 83709

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